

# FIRE II Cirrus

## Mission Summary



**Date: November 13, 1991**

**Julian Day: 317**

**Experiment Day: 1**

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Mission Scientist: David Starr  
Deputy Mission Scientist: none

Mission Objective:

Cloud Microphysics and Remote Sensing

Mission Description:

In situ microphysical, thermodynamic, and dynamic profiling of cirrus and alto clouds in close coordination with ground-based wind profilers; 8.6 mm Doppler and 3 mm radars and Doppler lidar observations at Hub; and lidar obs at Parsons.

Weather Synopsis:

Mild and breezy in Coffeyville with a high of 72 and winds from the south at 15 to 25 knots. Clear during the morning hours. Multi-layered, middle and high level clouds covered most of the sky from noon until sunset. Cirrus patches, generating cells, fall streaks and cirrocumulus were observed along with a variety of alto cloud forms. Individual cloud layers were scattered to broken at various times.

Synoptic Situation:

Cirrus and middle level cloud outflow from vortex over central Baja through Arizona and northern Oklahoma. Subtropical jet stream cirrus through northern Mexico and central Texas (decaying tropical storm off west coast of southern Mexico). Well-defined and eastward-moving baroclinic leaf system associated with polar jet stream over Montana. Tropopause heights were about 13 km at Norman and 11 km at Topeka and at both levels at Dodge City - upper tropospheric winds are strong (80 knot max) and westerly. Rain showers moving northward over Texas. Mission sampled the northern edge of a large area of cirrus clouds in southwest and south central U.S.

Aircraft	Depart	Land	Notes
NASA ER-2			No Flight
NCAR King Air	14:10 CST	16:15 CST	Excellent data - good mission, Flight cut short - mechanical problem
NCAR Sabreliner			No Flight
UND Citation			No Flight

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	20:20:18	41.31	70.77	yes
	10:25:18	51.44	290.26	yes
NOAA-12	14:30:53	14.80	284.82	yes
	01:50:47	34.07	259.62	yes

Rawinsonde Operations:

- Inner NWS stations (Type A): Routine @ 12 and 00 UTC
- Outer NWS stations (Type B): Routine @ 12 and 00 UTC
- Hub CLASS station: Satellite overpasses @ 20, 10, 14, 02 UTC
  - (replicator test flight at 17 UTC)
- Remote CLASS stations: Test flight at 20 UTC from Arkansas City
- Hub GSFC/WFF station: Ozone at 17 UTC (to 14.5 mb), RAOB at 22 UTC
- CSU Parsons station: 17 and 22 UTC

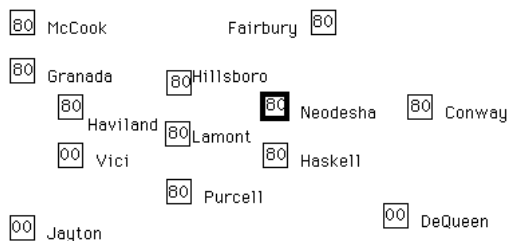
FIRE Profiler Status:

- CSU 400 MHz @ Parsons: Continuous operation (no RASS)
- PSU 50 MHz @ Coffeyville: Continuous operation (noisy)
- NOAA 405 MHz @ Coffeyville: Not Operational

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NWS Wind Profiler Status:





#### SPECTRE Operations:

Conducted ozone and CO<sub>2</sub> sounding (latter via small aircraft to 8700'). Got good data with a low (3 km base) stratus deck during evening hours with interferometers (2), Raman lidar, 50 MHz wind profiler, and rawinsonde soundings. RASS (50 MHz) still has noise problems. Raman lidar experiencing EM-interference problems. Working on solutions. Using our sonde data in FASCODE produces >20 disagreements with spectra measured by Univ. of Wisconsin. Disagreement attributed to 20umidity low end limit on sonde used - Raman indicated very dry conditions (RH < 20) in some layers.

#### Aircrew/Mission Scientist Debrief Notes:

- **KING AIR EXCELLENT FLIGHT!**  
Take-off at 2010 UTC. Noticed scattered low scud stratus on climb-out (not noticed by ground observers or detected by remote sensors - stratus cloud overcast developed in early evening) and multiple cloud layers beginning at 5.4 km. Thick band of cirrus to north of Hub - probably what we saw on satellite imagery. Liquid phase cloud layer from 7.1 to 7.28 km - flew long leg Hub to Parsons in this layer toward end of mission. Significant wind shear detected at base of cirrus layer (30K). Rolls and waves evident in cloud features. Took ice crystal slides at -40 C over Hub at 31K Particle concentrations up to 25-30 per liter were detected by PMS probes - some were beautiful bullet rosettes. Flew legs at 31K and 30K in lower part of cirrus cloud. Attempted spiral but not enough depth within operating range (spiral contrail seen over radar site and drifting to ENE). Descended into alto cloud for flight to Parsons - cloud now from 20K to 23K. Experienced strong icing (-18.5 C at 21K) - no large ice crystals detected. Bleeder valve problem forced rapid return to Hub from Parsons. Did not perform weigh point recon as planned (low level overflight of all surface sites). Land at 2211 UTC.

#### Significant Hardware Problems:

- U. Utah and U.Wisc lidars not operational.
- NOAA 405 MHz profiler not operational.
- Sabreliner radiometric instruments not ready.
- ER-2 instruments not ready.

#### Highlights of FIRE Operations:

- Beautiful intercomparison of mm radar and in situ microphysical observations.
- Radar data displays looked great.
- Surprised that the radars clearly detected and showed internal structure of the supercooled cloud.
- Good lidar observations taken at Parsons.
- Raman lidar observations before mission (pre-dawn) clearly showed the distinct moist layers that later formed the observed cloud layers.

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## Instrument Logs

Active Sensors

Active Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
Utah Lidar H																									NOT OPERATIONAL
LaRC Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Wisc HSR Lidar H																									NOT OPERATIONAL
Wisc Vol Image Lidar																									TESTING
GSFC RAMAN Lidar H															X	X	X	X							EM-INTERFERENCE - DATA GOOD ALSO TOOK DATA ON 13TH, 02-10 UTC
NOAA CO2 Lidar H						X	X		X	X	X														
NOAA Radar H			X	X	X	X	X	X	X	X	X	X													
PSU Radar H		X	X	X	X	X	X	X	X	X	X	X													
PSU Laser Ceilometer H		X	X	X	X	X	X	X	X	X	X	X													
PSU 50 MHZ Wind Prof H	X	X	X	X	X	X	X	X	X	X	X	X													
PSU/NOAA 50 MHZ RASS H	X	X	X	X	X	X	X	X	X	X	X	X													RUNNING BUT NEEDS ADJUSTMENT
NOAA 405 MHZ RASS H																									NOT OPERATIONAL
LaRC Lidar P	X	X	X	X	X			X	X	X	X	X	X	X											
CSU Wind Prof/RASS P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	NO RASS
CSU Laser Ceilometer P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

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#### Passive Sensors



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Passive Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
NOAA $\mu$ -wave Radiometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NOAA Sun Photometer H						X																			
NOAA H2O Photom H																									NOT OPERATIONAL
NOAA IR Flux Radiom. H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NOAA Dobson Ozone H																									NO OBSERVATIONS, CLOUDS
NOAA Surface Ozone																									
NOAA Trace Gas H						C		C	C																17 SURFACE, 19-20 AIRCRAFT FLIGHT
PSU $\mu$ -wave Radiometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	NEEDS ADJUSTMENT
PSU Sun Photometer H																									NO DATA TAKEN
PSU Solar Flux Radiom. H	X	X	X	X	X	X	X	X	X	X	X	X													NO OBSERVATIONS
PSU IR Flux Radiometers H	X	X	X	X	X	X	X	X	X	X	X	X													
PSU Sky Video H						X	X	X	X	X	X	X													
Utah IR-Window Radiom. H																									NOT ON SITE
Utah Sky Video H																									NOT ON SITE
LaRC Video H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
AFGL Sky Imager H							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Ames Radiometer H																									NOT ON SITE
Denver Solar Radiom. H																									TESTING
Denver IR-Spectrometers H									X	X	X	X	X	X	X										
GSFC IR-Spectrometer H																									NOT OPERATIONAL
Wisc. IR-Spectrometer H						X	X	X	X	X	X	X	X	X	X	X									
MRI Sun Photometer H																									NOT OPERATIONAL
MRI IR Radiometer H																									NOT OPERATIONAL
MRI Spectro-Radiom. H																									NOT OPERATIONAL
MRI Solar Flux Radiom. H																									NOT OPERATIONAL
GSFC Photometer H																									NOT OPERATIONAL
CSU Sun Photometer P																									NOT OPERATIONAL
CSU IR-Window Radiom. P																									NOT OPERATIONAL
CSU Solar Flux Radiom. P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CSU IR Flux Radiometers P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CSU IR-Spectrometer P						X			X																
CSU Sky Video P																									NOT OPERATIONAL

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#### Sondes and Surface Meteorology

Sondes + Sfc Met Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
NOAA Ozone Sonde H													X												REACHED 14.5 MB, H2O TO 100 MB
WFF Sonde H					X					X	X	X	X	X											
NCAR Cloud Ice Sonde H																									NO LAUNCHES
NCAR/CLASS Sonde H		X						X					X									X			
NCAR PAMS H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NCAR/CLASS (remote)																									NO LAUNCHES
NCAR PAMS (remote)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	IOLA DOWN FROM 23 UTC
CSU Sonde P						X			X																
CSU Sfc Meteor P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Type A NWS Sonde	X												X												
Type B NWS Sonde	X												X												
PSU Sfc Meteor H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

